Motormaster® I Head Pressure Controller Accessory for Split System Condensing Units 15 and 20 Tons

Installation Instructions

Part Numbers CALOWAMB018A00 - CALOWAMB029A00, CALOWAMB037A00 - CALOWAMB042A00

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IMPORTANT: Read these instructions completely before attempting to install this accessory.

SAFETY CONSIDERATIONS

Installation and servicing of air-conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair, or service air-conditioning equipment.

Untrained personnel can perform basic maintenance functions of cleaning coils and filters and replacing filters. All other operations should be performed by trained service personnel. When working on air-conditioning equipment, observe precautions in the literature, tags and labels attached to the unit, and other safety precautions that may apply.

Follow all safety codes, including ANSI (American National Standards Institute) Z223.1. Wear safety glasses and work gloves. Use quenching cloth for unbrazing operations. Have fire extinguisher available for all brazing operations.

It is important to recognize safety information. This is the safety-alert symbol ⚠. When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury.

Understand the signal words DANGER, WARNING, CAUTION, and NOTE. These words are used with the safety-alert symbol. DANGER identifies the most serious hazards which **will** result in severe personal injury or death. WARNING signifies hazards which **could** result in personal injury or death. CAUTION is used to identify unsafe practices, which **may** result in minor personal injury or product and property damage. NOTE is used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could cause personal injury or death.

Before performing service or maintenance operations on unit, turn off main power switch to unit and install lock(s) and lockout tag(s). Ensure electrical service to rooftop unit agrees with voltage and amperage listed on the unit rating plate. Unit may have more than one power switch.

⚠ CAUTION

EQUIPMENT DAMAGE HAZARD

Failure to follow this caution may result in damage to equipment.

When removing panels from the unit, be careful not to damage the roof or other surfaces with the panels.

GENERAL

Motormaster® I solid-state head pressure control regulates outdoor (condenser) fan speed during Cooling mode operation. A temperature sensor, mounted on a return bend of the outdoor (condenser) coil, controls the speed of approved outdoor (condenser) fan motors in order to maintain a constant head pressure in the outdoor (condenser) coil. When properly installed, the control will maintain the appropriate head pressure at low ambient temperatures down to –20°F (–28°C).

On all size 16/180/181 and 25/240/241 units, the single Motormaster I control is connected to two outdoor (condenser) fan motors – OFM1 and OFM3. The additional fan motors — OFM2 (all units) and OFM4 (size 25/240/241 only) — are staged off at mild ambient temperatures (below 40°F (6°C) by low ambient temperature switch LAS through low ambient relay LAR.

HEAT PUMP ONLY

Speed Control Bypass (SCB) relay is energized during the Heating mode. The SCB relay bypasses the Motormaster controller output to force all outdoor (condenser) fan motors to run at full speed during Heating mode.

575V ONLY

On 575V units, the 575V motors installed in positions OFM1 and OFM3 are replaced with 460V fan motors, powered through a stepdown (575V to 460V) transformer and controlled through a 460V Motormaster® controller.

Wind baffles are required to prevent wind cross currents from causing abnormally low condensing temperatures. Wind baffles must be field fabricated and installed using the provided dimensions.

Before Installing

Inspect the contents of this accessory package before installing. Refer to the Package Contents table on page 2 for parts listing. Contact the kit supplier if any parts are missing or damaged.

Verify kit usage and voltage before starting. Refer to the package contents table on page 2. Check controller and motor voltage against unit voltage. The Motormaster kit for 575V units use 460V controller and motors with stepdown transformer.

PACKAGE CONTENTS

ITEM	CALOWAMB0*****								
	18A00	19A00	20A00	21A00	22A00	23A00	24A00	25A00	26A00
Motormaster® I Control/Sensor	1 qty	1 qty	1 qty	1 qty	1 qty	1 qty	1 qty	1 qty	1 qty
Transformer, 575V to 460V	—	—	1 qty	—	—	1 qty	—	—	1 qty
Mounting Bracket	1 qty	1 qty	1 qty	1 qty	1 qty	1 qty	1 qty	1 qty	1 qty
Outdoor Fan Motor	2 qty	2 qty	2 qty	2 qty	2 qty	2 qty	2 qty	2 qty	2 qty
Low Ambient Temperature Switch	1 qty	1 qty	1 qty	1 qty	1 qty	1 qty	1 qty	1 qty	1 qty
Fan Motor Capacitor	—	—	1 qty	—	—	1 qty	—	—	1 qty
Low Ambient Relay	1 qty	1 qty	1 qty	1 qty	1 qty	1 qty	2 qty	2 qty	2 qty
Relay	1 qty	1 qty	1 qty	2 qty	2 qty	2 qty	—	—	—
Mounting Supplies	yes	yes	yes	yes	yes	yes	yes	yes	yes
Wiring Supplies	yes	yes	yes	yes	yes	yes	yes	yes	yes

ITEM	CALOWAMB0*****								
	27A00	28A00	29A00	37A00	38A00	39A00	40A00	41A00	42A00
Motormaster® I Control/Sensor	1 qty	1 qty	1 qty	1 qty	1 qty	1 qty	1 qty	1 qty	1 qty
Transformer, 575V to 460V	—	—	1 qty	—	—	1 qty	—	—	1 qty
Mounting Bracket	1 qty	1 qty	1 qty	1 qty	1 qty	1 qty	1 qty	1 qty	1 qty
Outdoor Fan Motor	2 qty	2 qty	2 qty	2 qty	2 qty	2 qty	2 qty	2 qty	2 qty
Low Ambient Temperature Switch	1 qty	1 qty	1 qty	1 qty	1 qty	1 qty	1 qty	1 qty	1 qty
Fan Motor Capacitor	—	—	1 qty	—	—	1 qty	—	—	1 qty
Low Ambient Relay	2 qty	2 qty	2 qty	1 qty	1 qty	1 qty	1 qty	1 qty	1 qty
Relay	—	—	—	1 qty	1 qty	1 qty	2 qty	2 qty	2 qty
Mounting Supplies	yes	yes	yes	yes	yes	yes	yes	yes	yes
Wiring Supplies	yes	yes	yes	yes	yes	yes	yes	yes	yes

PACKAGE USAGE

MODEL	SIZE	CIRCUITS	VOLTAGE	PART NUMBER
Cooling Only Units				
38AUD/Z 16 569J*16A/D CAS 180/181	15 Ton	Single Circuit	208/230-3-60	CALOWAMB037A00
			460-3-60	CALOWAMB038A00
			575-3-60	CALOWAMB039A00
		Dual Circuit	208/230-3-60	CALOWAMB040A00
			460-3-60	CALOWAMB041A00
			575-3-60	CALOWAMB042A00
38AUD/Z 25 569J*25A/D CAS 240/241	20 Ton	Single Circuit	208/230-3-60	CALOWAMB018A00
			460-3-60	CALOWAMB019A00
			575-3-60	CALOWAMB020A00
		Dual Circuit	208/230-3-60	CALOWAMB021A00
			460-3-60	CALOWAMB022A00
			575-3-60	CALOWAMB023A00
Heat Pump Units				
38AUQ 16 575J*16 CHS180	15 Ton	Dual Circuit	208/230-3-60	CALOWAMB024A00
			460-3-60	CALOWAMB025A00
			575-3-60	CALOWAMB026A00
38AUQ 25 575J*25 CHS 240	20 Ton	Dual Circuit	208/230-3-60	CALOWAMB027A00
			460-3-60	CALOWAMB028A00
			575-3-60	CALOWAMB029A00

INSTALLATION

Check voltage of kit parts against unit voltage. Before starting, check controller and motor voltage against unit voltage.

NOTE: 575-v units use 460-v controller and motors with step-down autotransformer.

Changing Outdoor Fan Motors and Installing Motormaster® I Controller and Accessories

CHANGING OUTDOOR FAN MOTORS

Step 1 — Replace Outdoor Fan Motor

1. Disconnect power to the unit. Lock-out/tag-out.
2. Remove main access panel and control box cover.
3. At Capacitor CAP 1, disconnect all OFM BLK wires at TB3. Retain the BLK wire to relay OFR.
4. In some cases the OFM change out also requires the capacitor it uses to change. Refer to the Package Contents table (above) and the motor nameplate, to determine if the capacitor needs to be changed. Unscrew the capacitor strap carefully so that it can be reused. Remove the capacitor and store it in a safe place or discard properly. Using the capacitor strap, safely secure the new correct capacitor in the same location the old one was. Connect the wires the same way they were disconnected.
5. Identify fan-motor positions OFM1 and OFM3; refer to Fig. 1.
6. Trace the motor leads from OFM1 and OFM3 to the control box. Note wire path into the control box. Pull these leads out of the control box.
7. Remove the screws securing the OFM1 and OFM3 fan grilles from the unit top cover. Save these screws.
8. Remove the fan grille assemblies at OFM1 and OFM3 by lifting the assemblies straight up until the prop blades clear the fan deck. Invert the grille assemblies and place on a support surface.
9. Measure and record the dimension of the top edge of the prop blade to the grille.
10. For OFM1 and OFM3 assemblies. remove the prop fan from the motor shaft.
11. Observe the orientation of the fan motor wires at the grille and motor shell opening. Remove the fan motors from the grille center plate.
12. Attach the motors from the accessory kit to the grilles. Do not over-tighten the nuts onto the motor through bolt ends. Torque. Secure wires to grille as noted in Step 11.
13. Mount the prop fan onto the motor shaft. Locate the prop at the distance from the grille measured in Step 9 above. If the prop blade contacts the motor housing, adjust prop position until the prop clears the motor by $^1/_2$-in. (13 mm). Torque the prop set screws to 84 in.-lbs ± 12 in.-lbs.
14. Position the OFM1 grille assembly over its top panel opening and carefully insert the motor wires and prop though the opening and lower into place. Secure using screws removed in Step 7. Repeat for OFM3 grille assembly.
15. Rotate the prop fan to ensure there is no interference or contact with unit piping or motor wiring.
16. Route the motor leads into the control box as noted in Step 6.

Step 2 — Mount and Connect Motormaster I Controller

1. Locate the mounting plate in the kit and attach to unit side panel per Fig. 2 using the sheet metal screws included with the accessory.
2. Mount the Motormaster controller onto the mounting plate using four screws. The controller must be mounted vertically with leads at the bottom. To ensure electrical ground, use the serrated head mounting screws provided.
3. Route the Motormaster sensor cord to the Circuit 1 coil (right of compressors).
4. Route the RED and BLK wires from the Motormaster controller into the unit control box.
5. For 575v units, the supplied transformer (575v to 460v) also mounts to the bracket.

Step 3 — Mount and Wire Control Components

1. Refer to the control arrangement view Fig. 2 for component mounting locations.
2. Mount the low ambient relay (LAR) in the control box using the provided screws.
3. **FOR HEAT PUMP UNITS ONLY**: Mount the Speed Control Bypass (SCB) relay in the control box using the provided screws.
4. **FOR COOLING ONLY UNITS**: Mount the relay (TDR) in the control box using the provided screws. See Fig. 3 for single circuit units and Fig. 4 for dual circuit units.
5. Mount the low ambient fan staging temperature switch (LAS) to the top of the service valve housing (see Fig. 2).
6. Connect one of the YEL (LAS) wires to Y1 on the connection board (TB) and connect the other YEL wire to terminal 1 of the low ambient relay (LAR). See Fig. 5-12 for details, depending on unit type and voltage.

NOTE: DO NOT RECONNECT POWER TO THE UNIT UNTIL ALL STEPS HAVE BEEN COMPLETED.

7. Route YEL wires into unit control box.
8. **575V UNITS ONLY:** Mount the included 575V to 460V transformer on the Motormaster controller bracket.

NOTE: The 575V to 460V transformer (HT01AH858) is used as an auto-transformer (buck boost transformer), not as a traditional step down isolation transformer therefore it must be wired as per Fig. 10 (15 ton units) or Fig. 12 (20 ton units).

9. Wire control components as indicated on wiring diagram.
10. Coil up excess wire and secure next to controller.

Step 4 — Install Coil Temperature Sensor

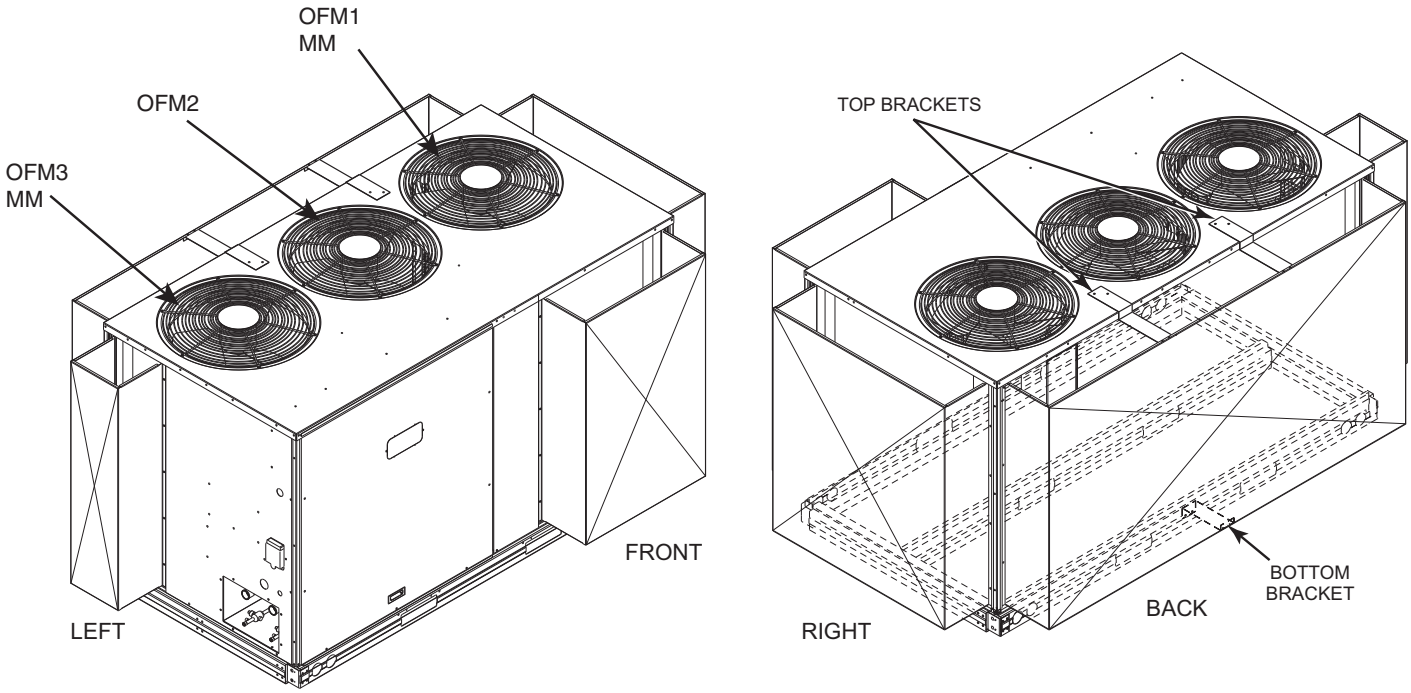
1. Install coil temperature sensor on circuit 1 header tube, located at the right of the compressors. Refer to Fig. 13 and 14 for the specific location by unit type.

Step 5 — Fabricate and Install Wind Baffles

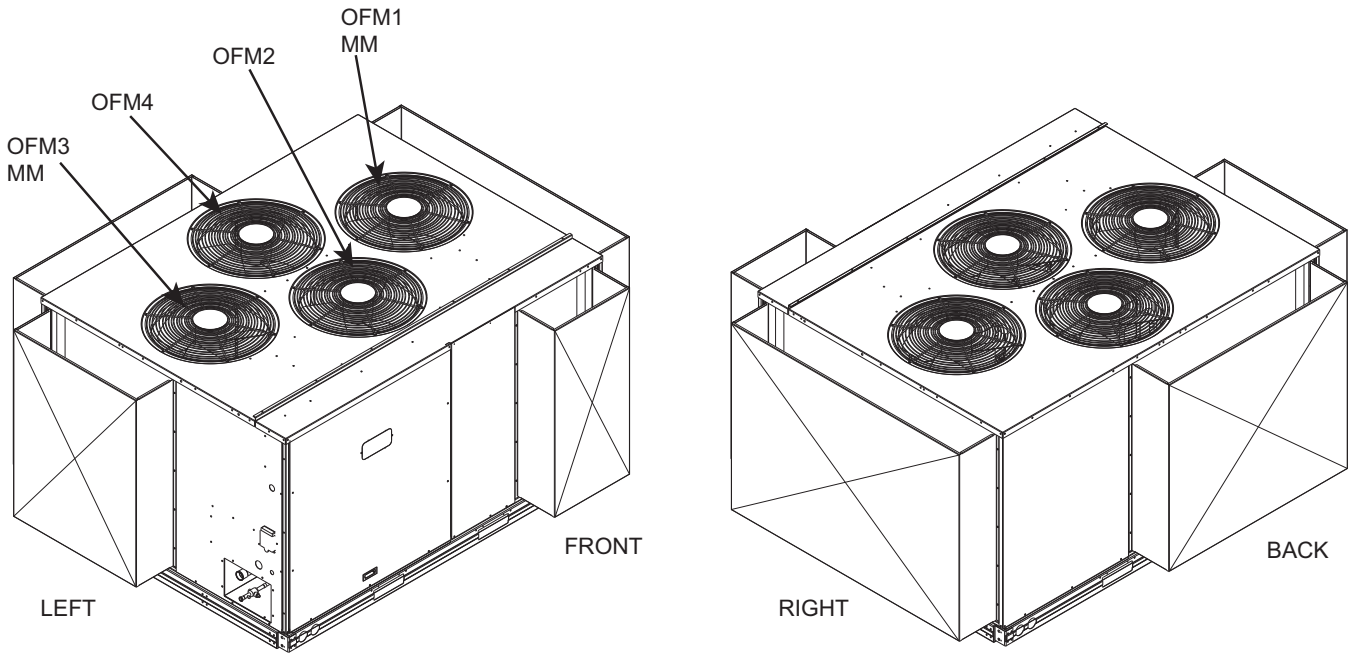
1. Using 20-gauge sheet metal, fabricate wind baffles and brackets. See Fig. 15 and 16 and Table 1 for details.
2. Install the wind baffles prior to restoring unit operation.

Step 6 — Restore Unit Operation

1. Inspect all wiring to verify that it is correct.
2. Ensure all wiring connections are tight.
3. Verify indoor fan motors are installed properly and check for rotation and clearance.
4. Verify wind baffles are installed properly and check for clearance.
5. Remove lock-out, restore unit power.
6. Enable unit cooling mode to verify Motormaster operation.
7. Verify Motormaster adjustment by placing the coil temperature sensor in hot (>120°F) or cool (<60°F) water.
8. Heat Pump units only, verify heating operation with SCB relay.
9. Return unit to normal operation, reattach coil temp sensor if removed.

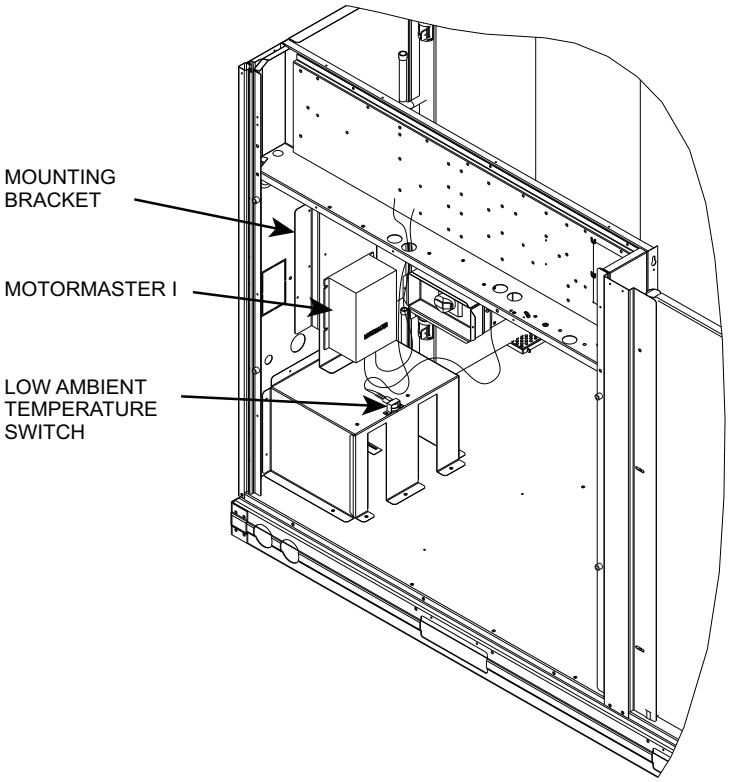


15 TON UNITS

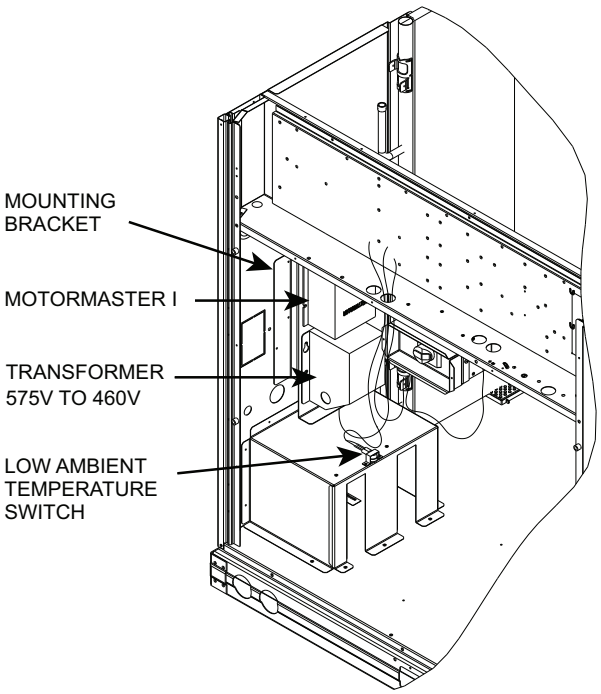


20 TON UNITS

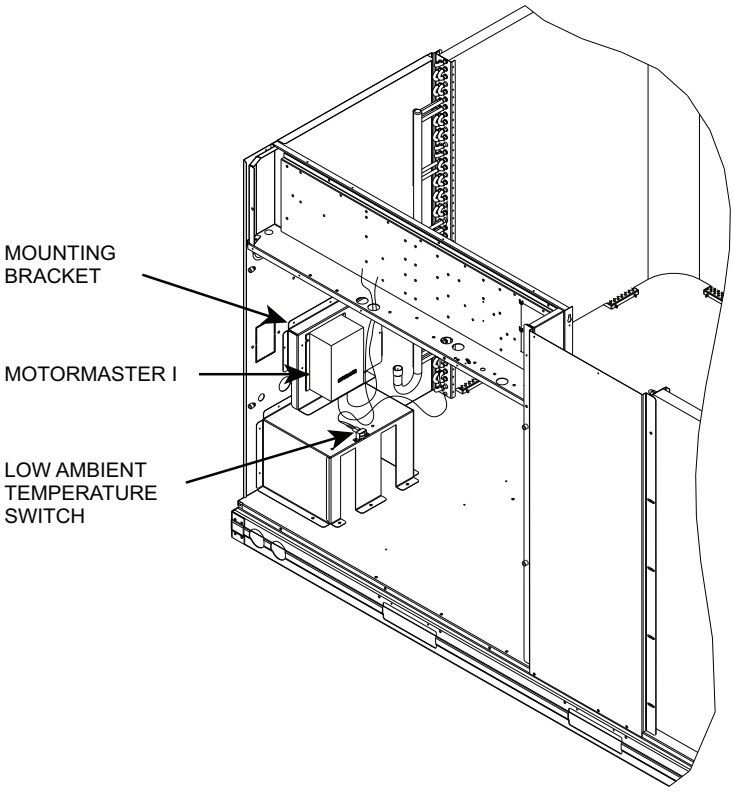
Fig. 1 — Wind Baffle Installation



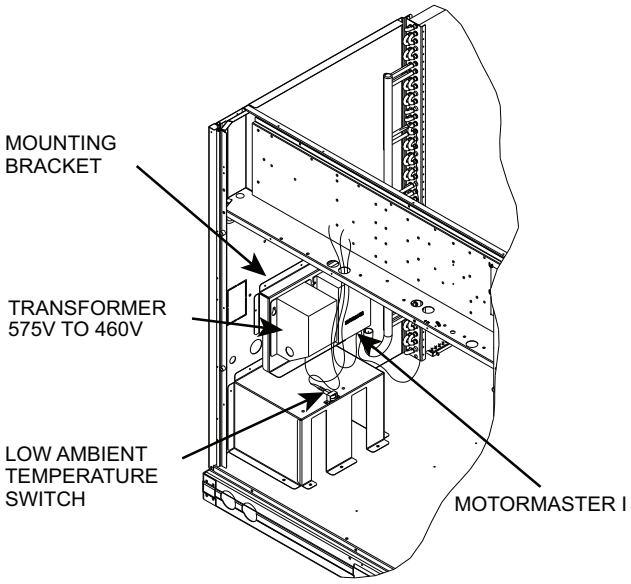
15 TON 208/230 AND 460V



15 TON 575V



20 TON 208/230 AND 460V



20 TON 575V

Fig. 2 — Motormaster® Controller Mounting

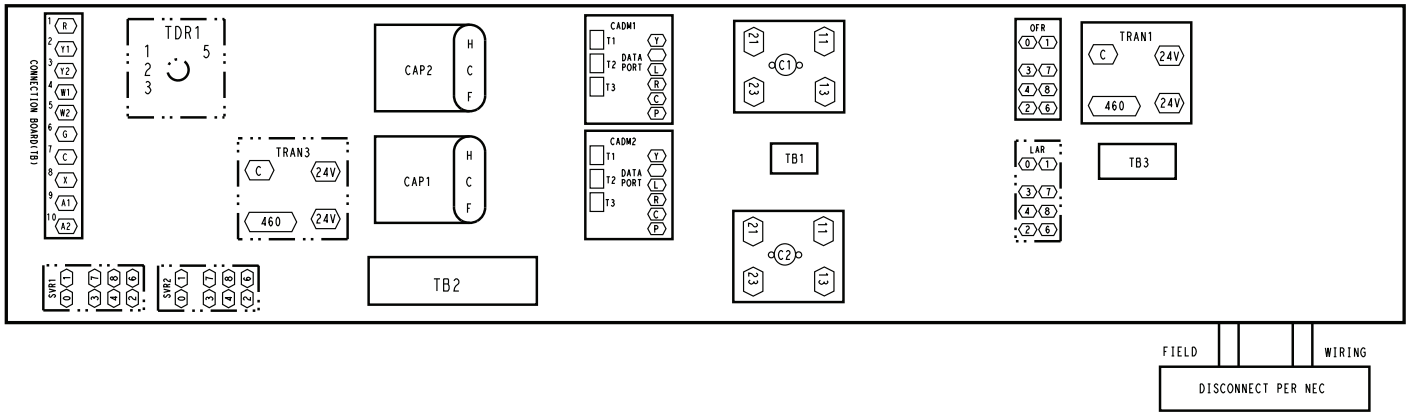


Fig. 3 — Relay (TDR) — Location in Control Box for Single Circuit Units

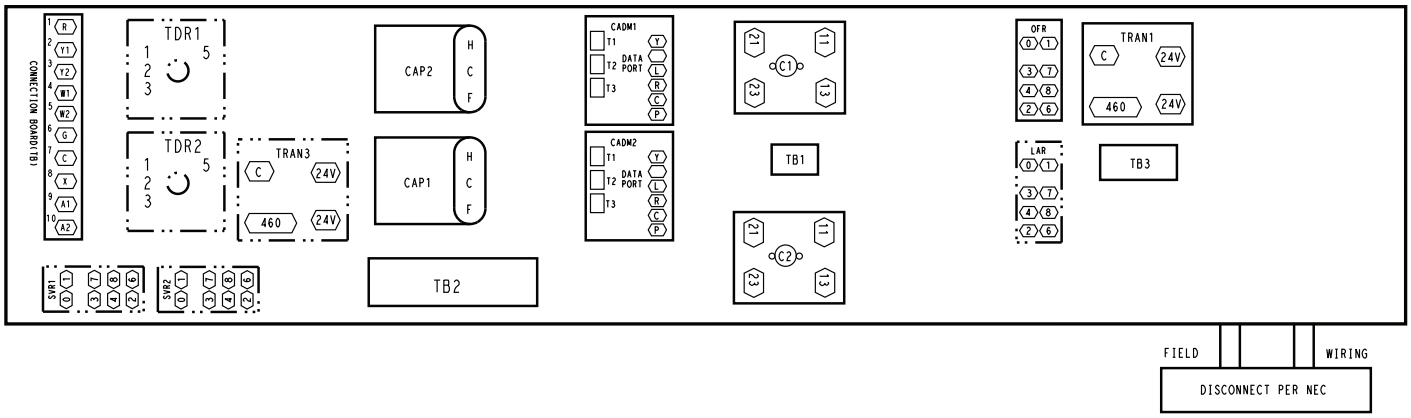


Fig. 4 — Relay (TDR) — Location in Control Box for Dual Circuit Units

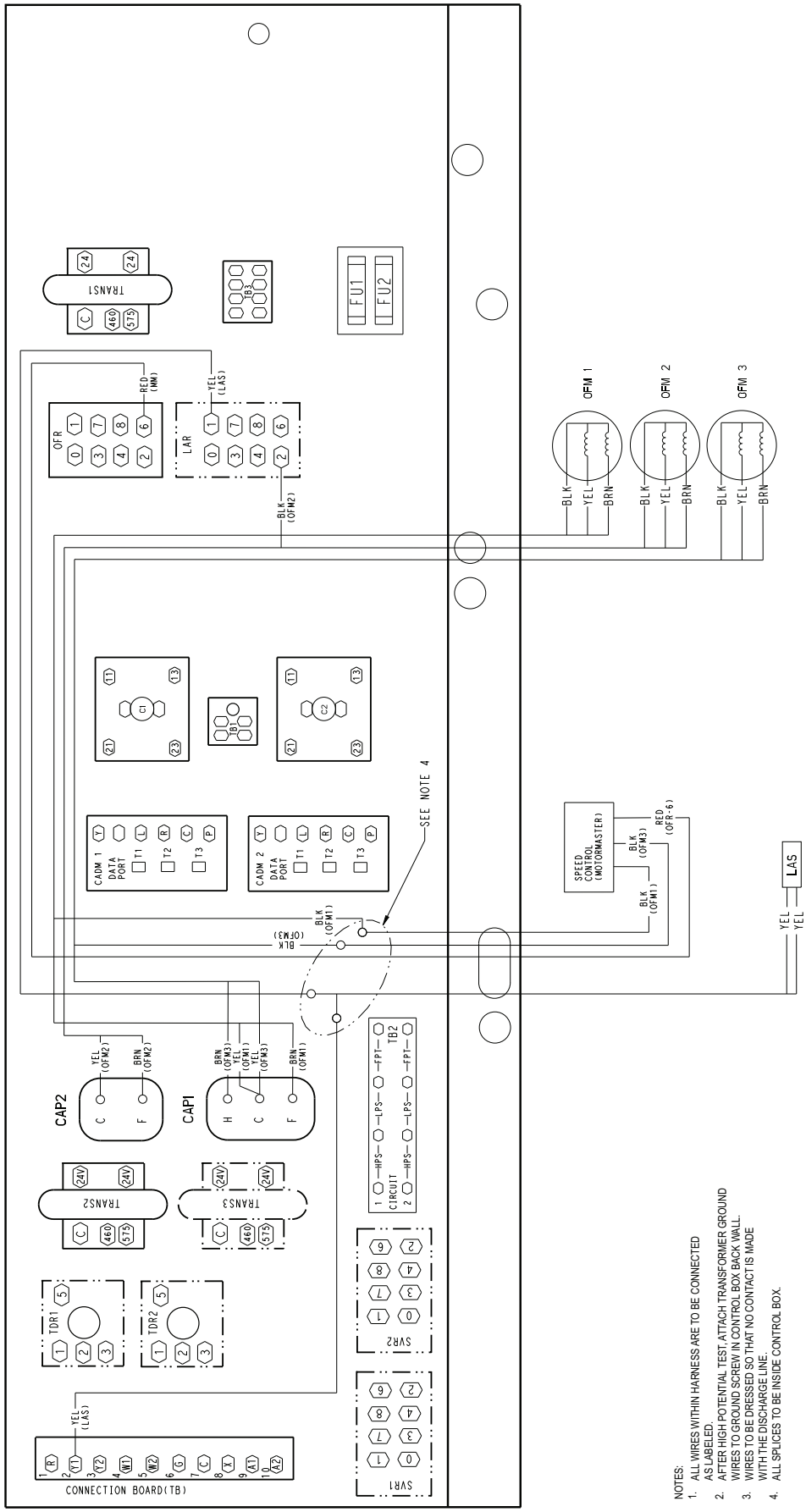


Fig. 5 — Motormaster® Wiring Details: 208/230/460V, 15 Ton Cooling Only Units

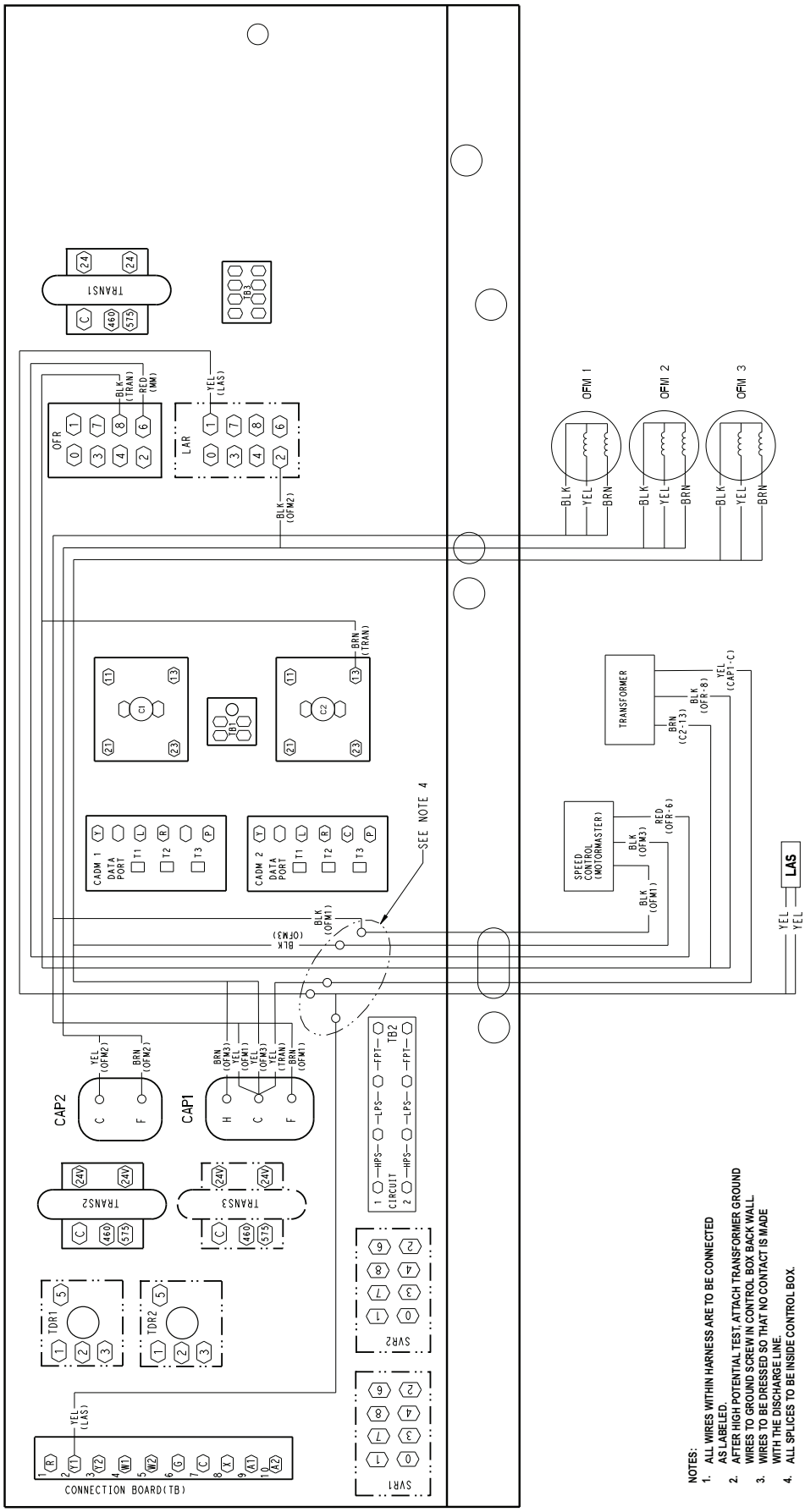


Fig. 6 — Motormaster® Wiring Details: 575V, 15 Ton Cooling Only Units

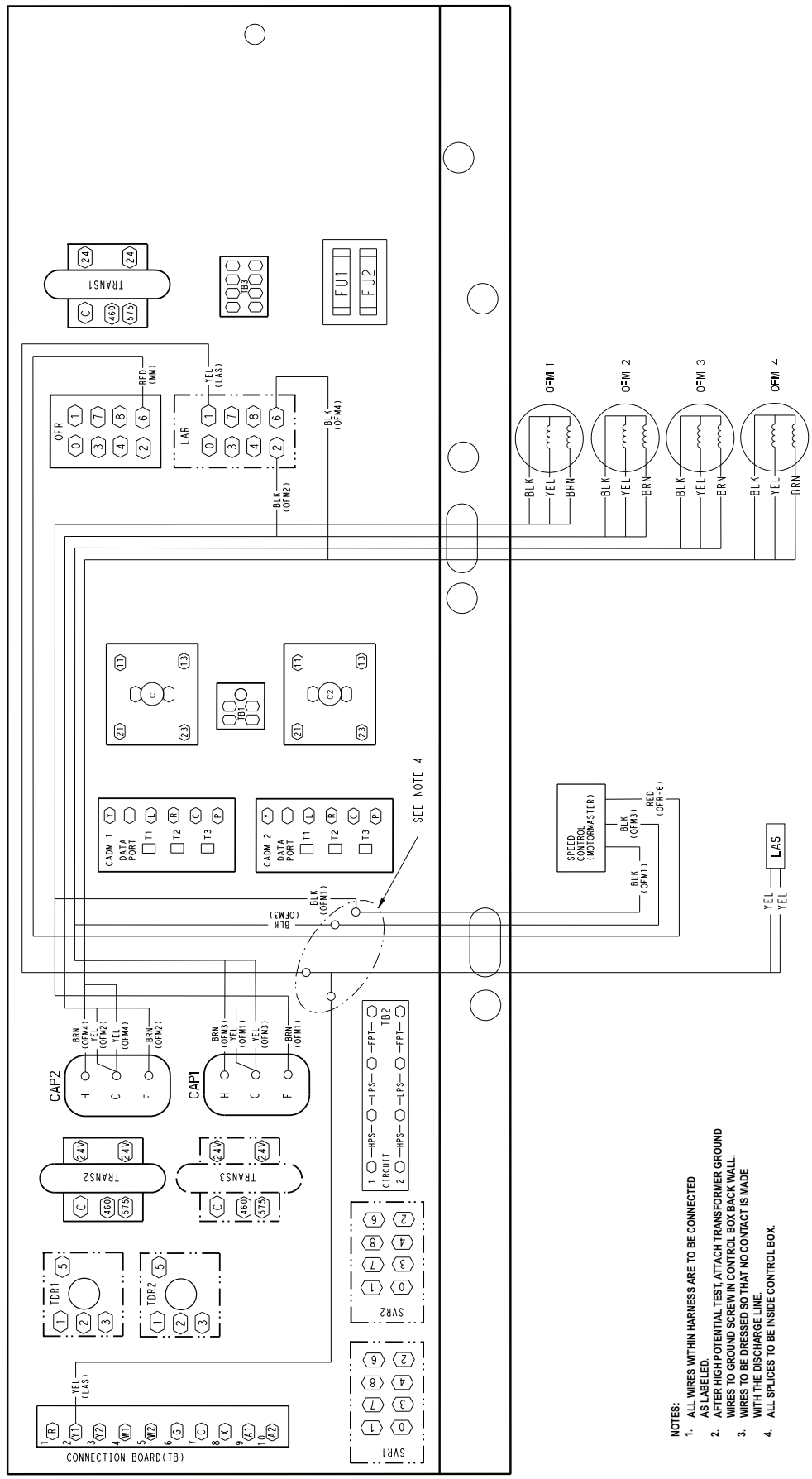


Fig. 7 — Motormaster Wiring Details: 208/230/460V, 20 Ton Cooling Only Units

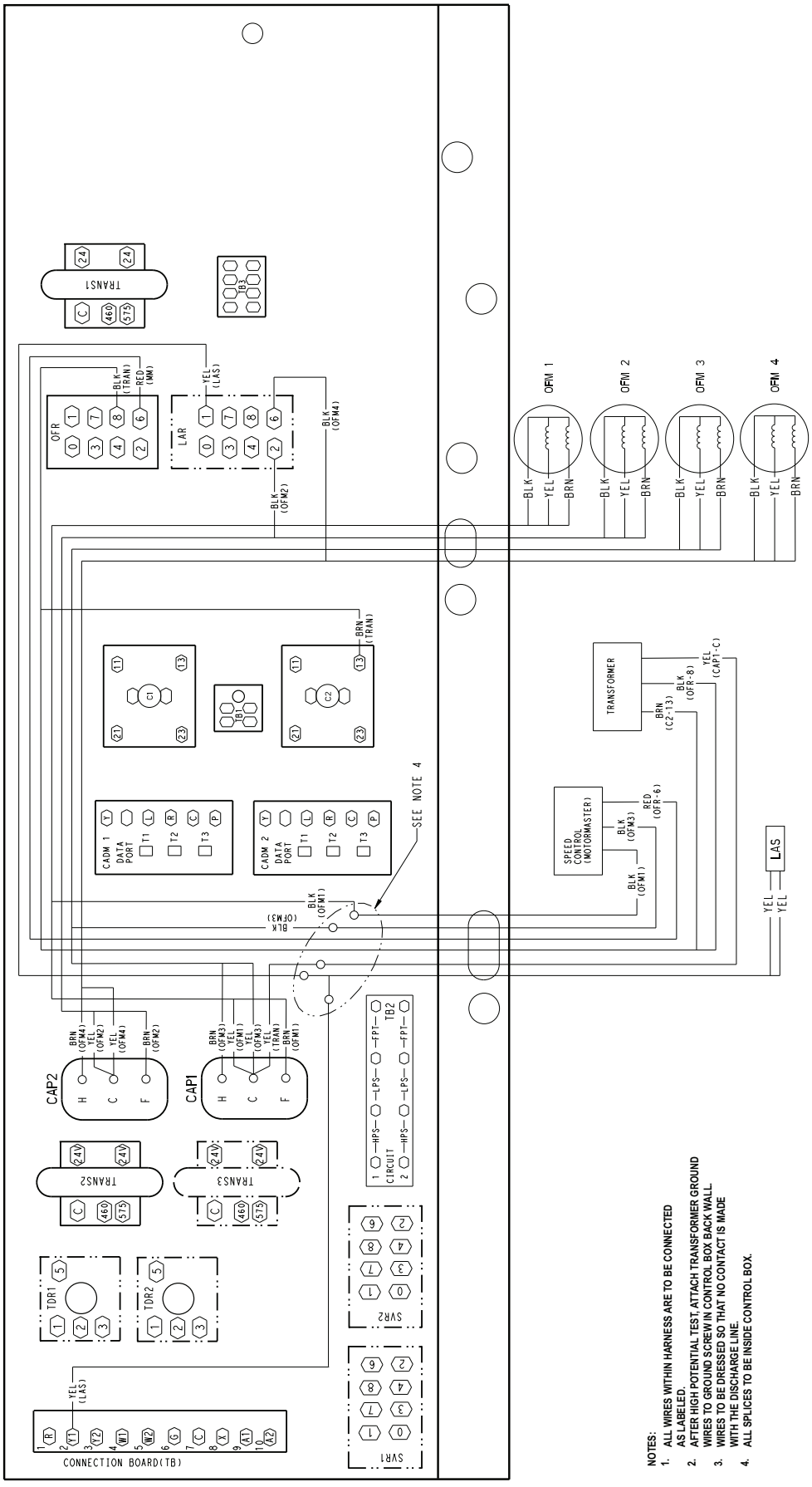


Fig. 8 — Motormaster® Wiring Details: 575V, 20 Ton Cooling Only Units

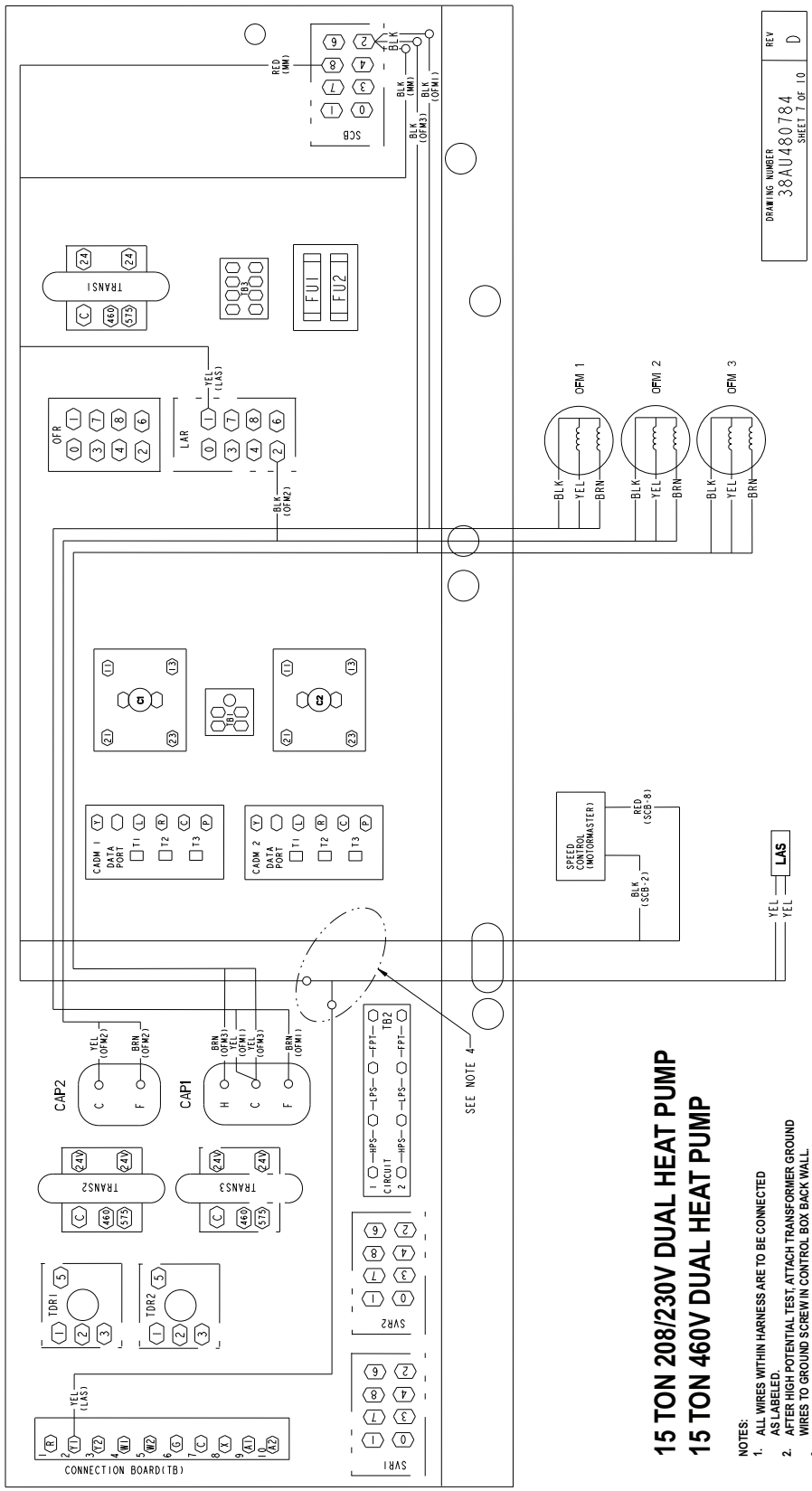


Fig. 9 — Motormaster Wiring Details: 208/230/460V, 15 Ton Heat Pump Units

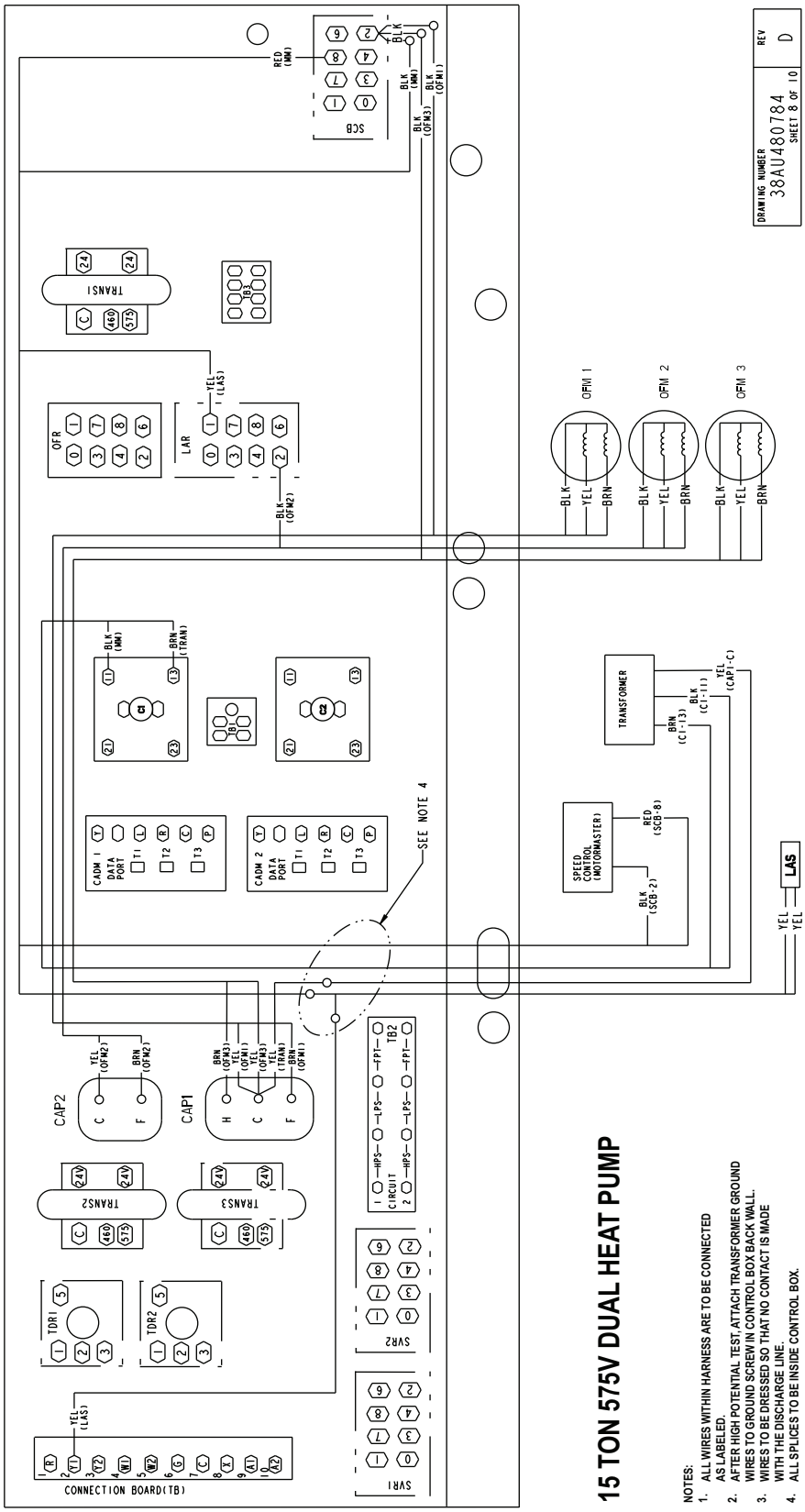


Fig. 10 — Motormaster® Wiring Details: 575V, 15 Ton Heat Pump Units

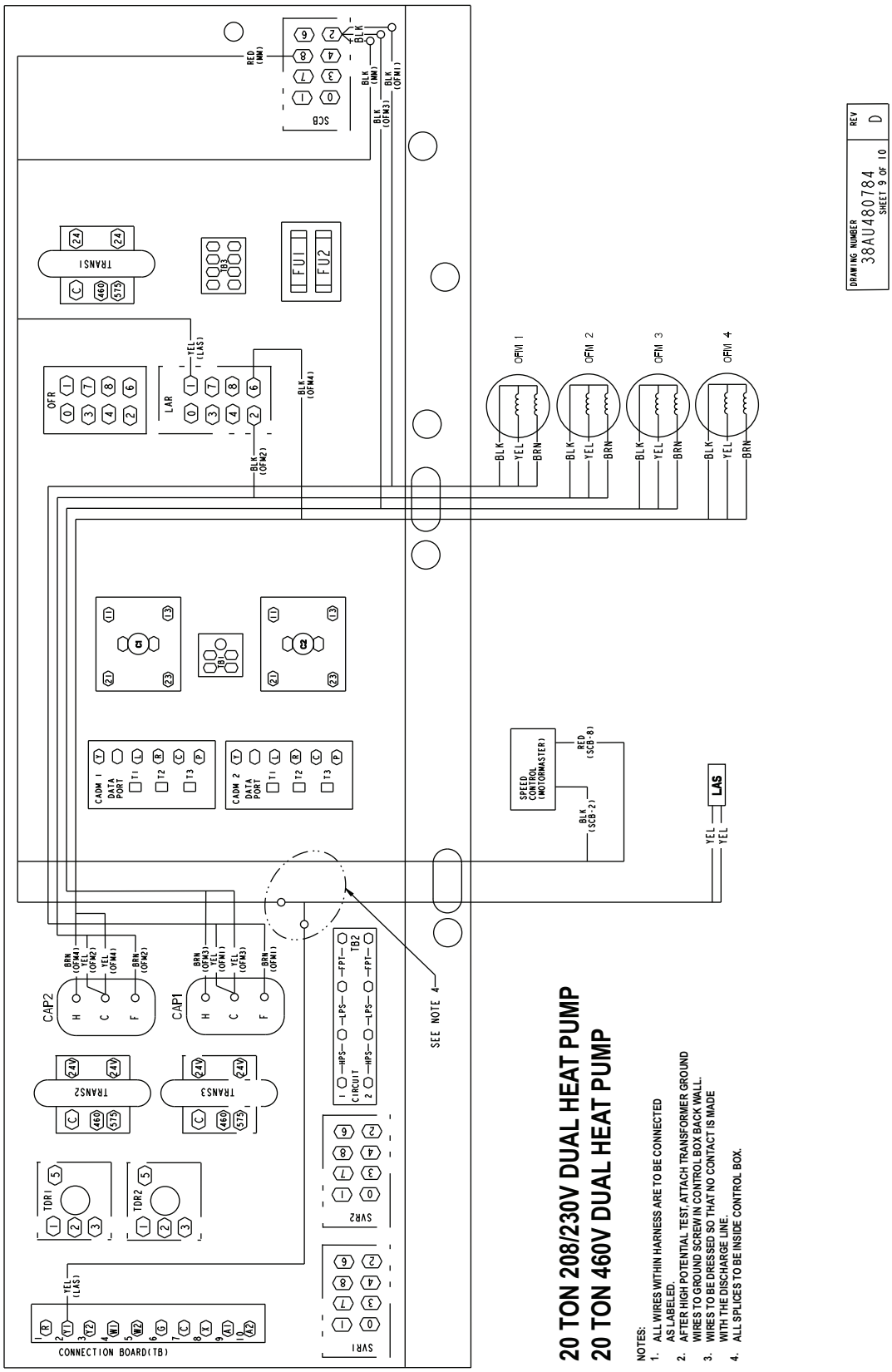


Fig. 11 — Motormaster Wiring Details: 208/230/460V, 20 Ton Heat Pump Units

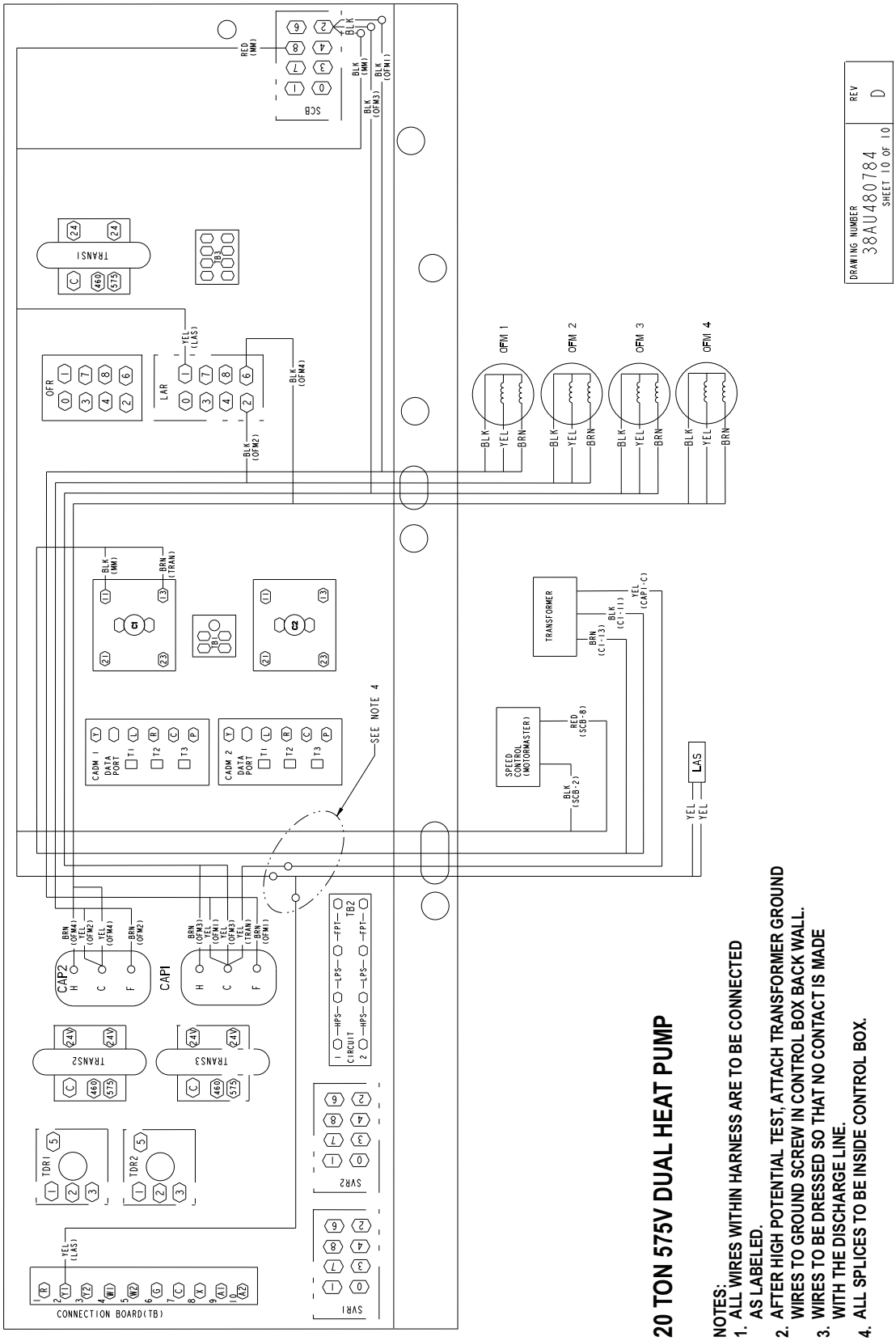
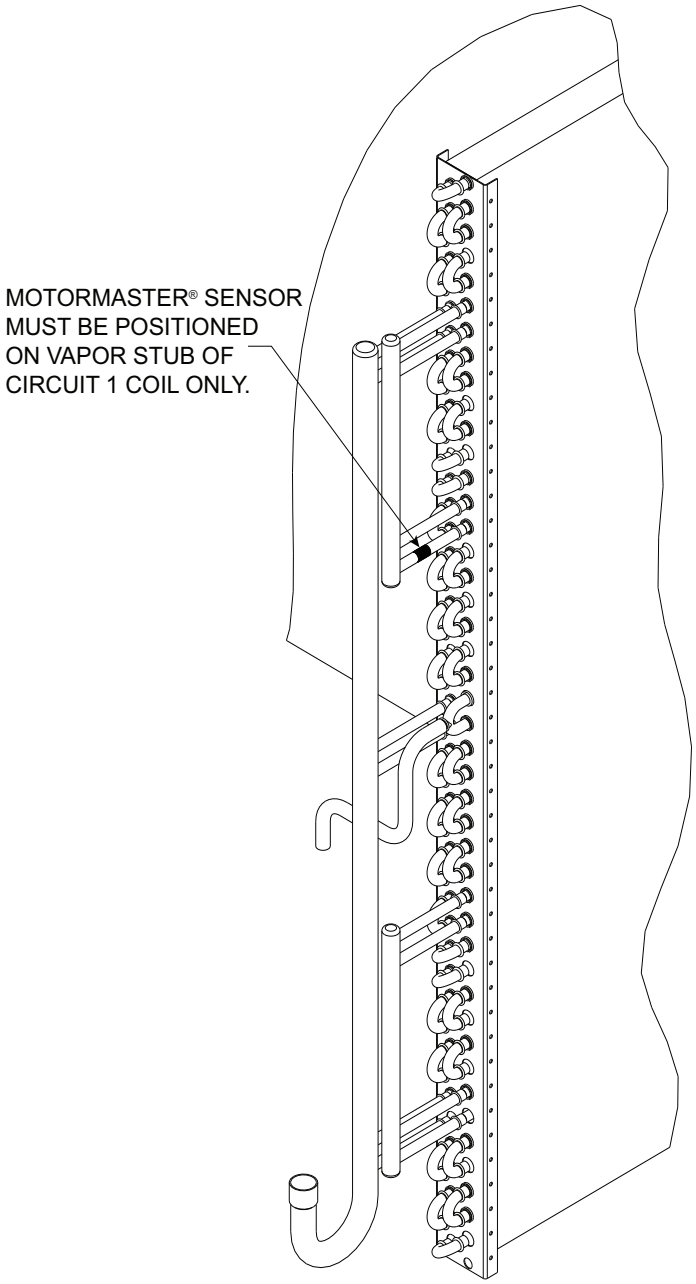


Fig. 12 — Motormaster® Wiring Details: 575V, 20 Ton Heat Pump Units



MOTORMASTER SENSOR LOCATION -
RTPF COIL UNITS ONLY:
15 AND 20 TON, SINGLE AND DUAL
CIRCUIT UNITS.

Fig. 13 — Sensor Location — Cooling Only Units

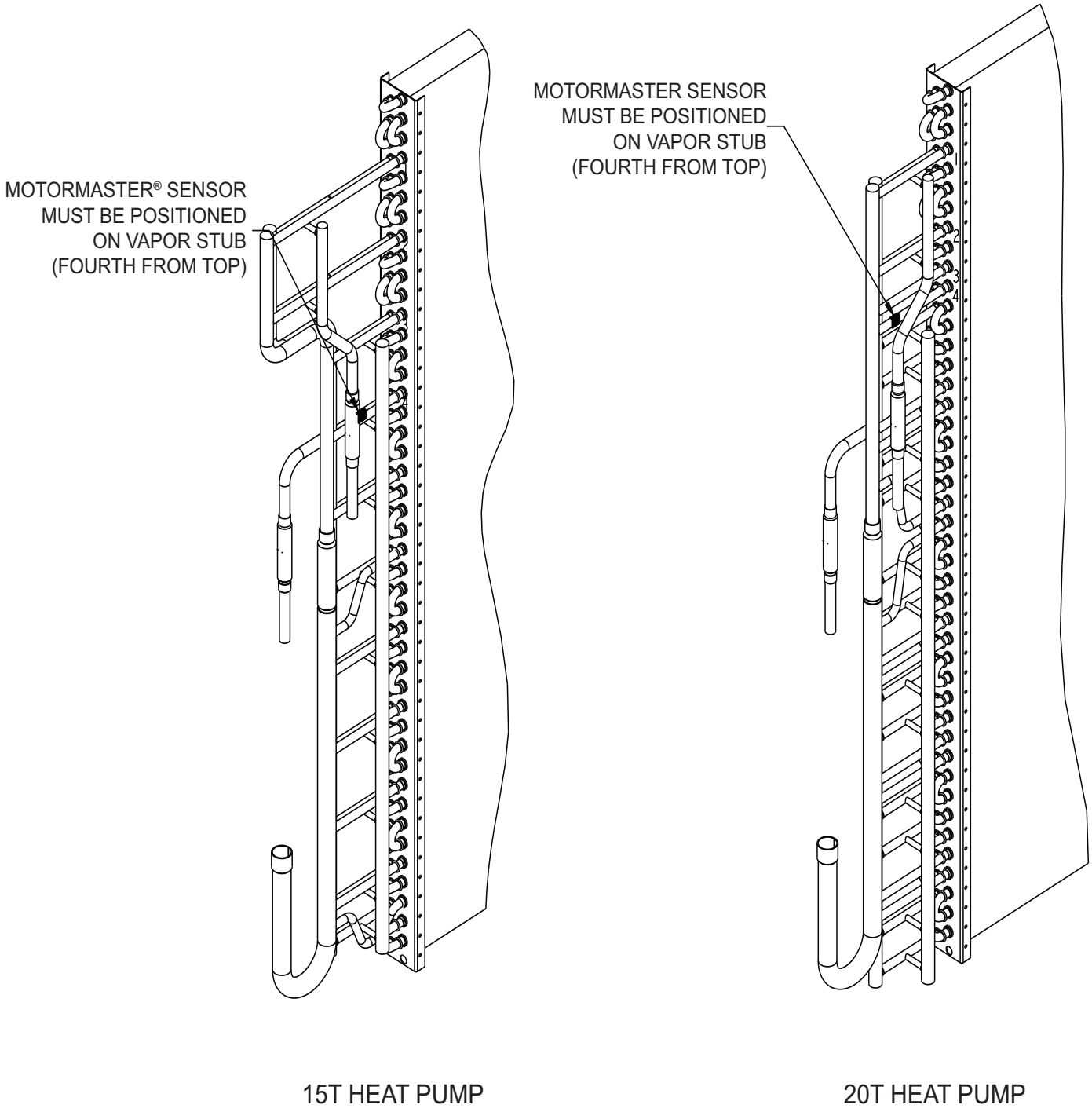


Fig. 14 — Sensor Location — Heat Pump Units

Table 1 — Wind Baffle Dimension

UNIT	BAFFLE	DIMENSIONS — INCHES								
		A	B	C	D	E	F	G	H	J
15 TON	LEFT SIDE	19 3/4	20 1/2	21 1/4	43 1/8	8 3/8	18	27 1/4	40	—
	BACK	80 1/4	81	81 3/4	43 1/8	8 3/8	18	27 1/4	40	—
	RIGHT SIDE	38 3/4	39 1/2	40 1/4	43 1/8	8 3/8	18	27 1/4	40	—
	FRONT	34 1/8	34 1/4	35 5/8	43 1/8	6 7/8	16 1/2	25 3/4	38 1/2	—
20 TON	LEFT SIDE	32 3/8	33 5/8	34 3/8	43 1/8	4 1/4	13 1/4	22 1/4	31 1/4	40 1/4
	BACK	47 3/4	48 1/2	49 1/4	43 1/8	4 1/4	13 1/4	22 1/4	31 1/4	40 1/4
	RIGHT SIDE	61 1/8	61 7/8	62 5/8	43 1/8	3 3/4	12 3/4	21 3/4	30 3/4	39 3/4
	FRONT	20 1/8	20 7/8	21 5/8	43 1/8	3 3/4	12 3/4	21 3/4	30 3/4	39 3/4

UNIT	BAFFLE	DIMENSIONS — MM								
		A	B	C	D	E	F	G	H	J
15 TON	LEFT SIDE	501	520	539	1095	212	457	694	1015	—
	BACK	2037	2056	2075	1095	212	457	694	1015	—
	RIGHT SIDE	983	1002	1021	1095	212	457	694	1015	—
	FRONT	866	885	904	1095	174	419	656	977	—
20 TON	LEFT SIDE	834	853	872	1095	108	337	565	794	1022
	BACK	1214	1233	1252	1095	108	337	565	794	1022
	RIGHT SIDE	1551	1570	1589	1095	95	324	552	781	1010
	FRONT	510	530	549	1095	95	324	552	781	1010

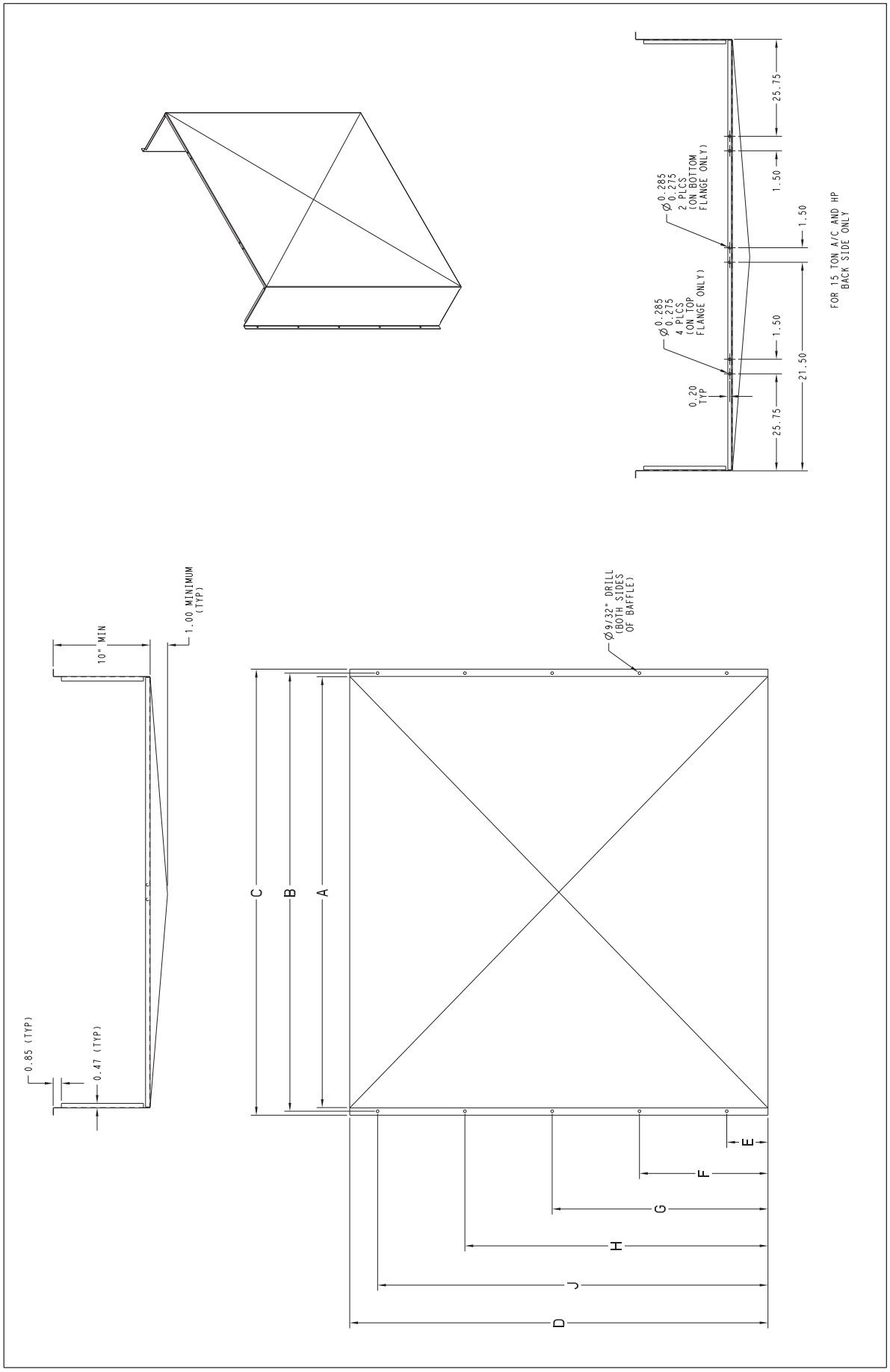


Fig. 15 — Wind Baffles — Fabrication

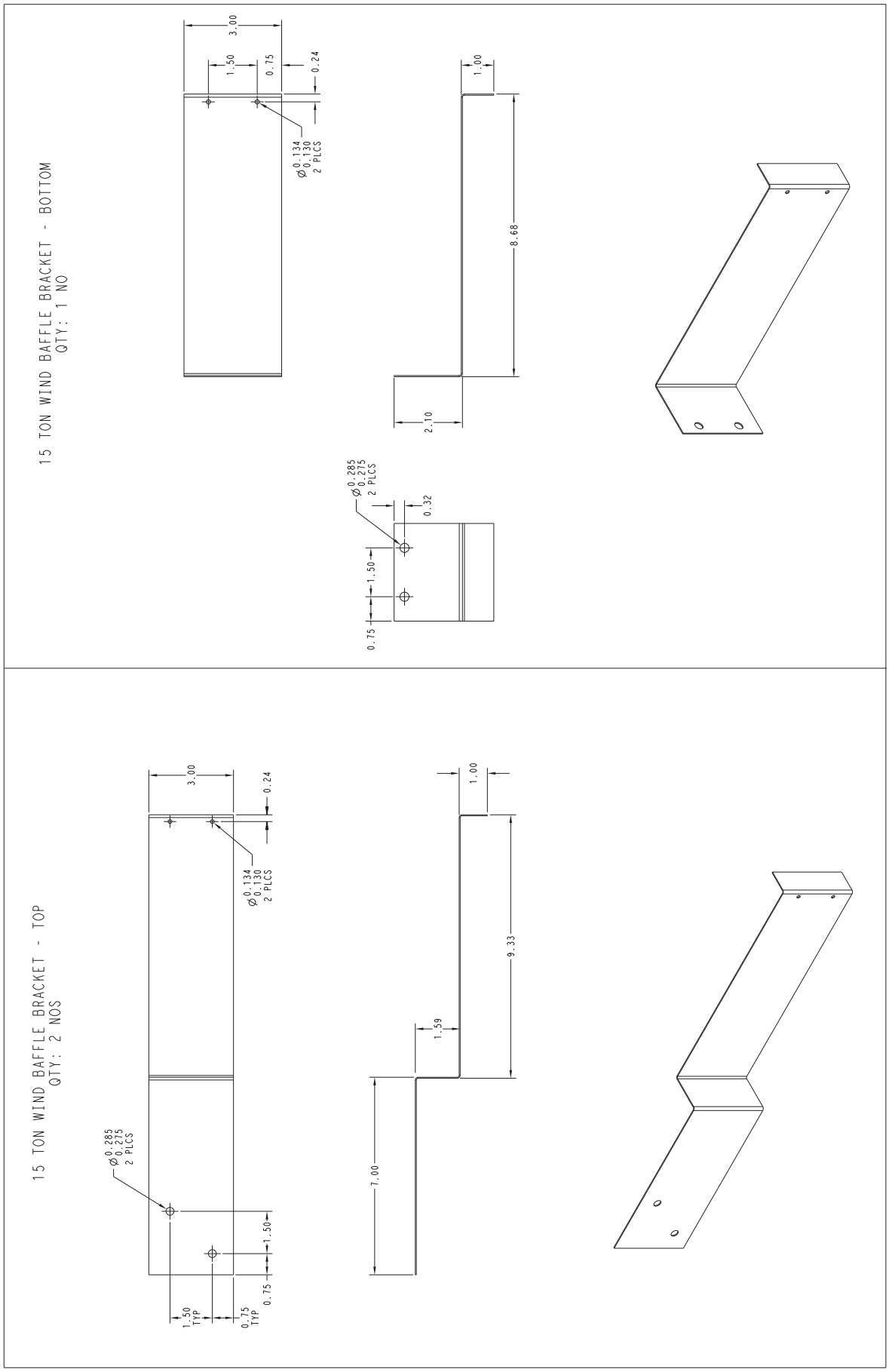


Fig. 16 — 15 Ton Wind Baffle Brackets — Fabrication

OPERATING SEQUENCE

Cooling Only Units

Fan on/off control in cooling-only units is provided by an outdoor fan relay (OFR).

In cooling mode, fan motor speed of outdoor motors OFM1 and OFM3 is regulated by the speed control temperature sensor on outdoor coil 1 for a minimum coil condensing temperature of approximately 100°F (38°C) at higher outdoor ambient temperature and 80°F (27°C) at lower ambient. Additionally, outdoor fan motor OFM2 and OFM4 are turned on/off by the low ambient temperature switch, LAS, operating the low ambient relay (LAR). The LAS control temperatures are open 42°F ± 5°F, close 57°F ± 5°F (open 5.5°C ± 2.8°C, close 13.9°C ± 2.8°C).

To override the speed control for full fan speed operation during service or maintenance, either:

a. remove sensor and place in hot water >120°F (>49°C), or
b. rewire to bypass control by connecting speed control input and output power wires.

Heat Pump Units Only

The heat pump unit's two outdoor fans are controlled through relay OFR with sequence logic from Defrost Board via output OF. The Speed Control Bypass (SCB) relay is energized during heating to bypass the Motormaster® control and operate the condenser fans at full speed.

On a thermostat Y1 call for Cooling, the Defrost Board output OF will energize relay OFR; outdoor fan motor operation is enabled. If the CADM anti-recycle timer has expired and compressor operation is permitted, contactor C will be energized, compressor will start and run and condenser coil temperature will increase. Both fan motors will start and speed will ramp up as condenser coil temperature increases, reaching full speed rpm as coil temperature rises above 100°F (38°C).

On a thermostat W1 call for heating, relay SCB is energized; its contacts bypass the Motormaster output, forcing both fan motors to run at full speed when enabled by OFR position. Defrost Board output OF energizes relay OFR; outdoor fan motors start and run at full speed. During Heating, a defrost cycle will cause the Defrost Board output OF to be removed; relay OFR is de-energized and both fan motors will stop for the duration of the Defrost cycle.

To override the speed control for full fan speed operation during service or maintenance, either:

a. remove sensor and place in hot water >120°F (>49°C), or
b. rewire to bypass control by connecting speed control input and output power wires.
c. Energize the SCB relay to bypass the Motormaster and force the condenser fans to full speed.

SPEED CONTROL SENSOR RESISTANCE

TEMPERATURE		RESISTANCE
°F ± 2°F	°C ± 1°C	Ohms, nominal
–22	–30	88,350
–4	–20	48,485
14	–10	27,650
32	0	16,325
50	10	9,950
68	20	6,245
77	25	5,000
86	30	4,028
104	40	2,663
122	50	1,801
140	60	1,244
158	70	876

TROUBLESHOOTING

Cooling Only Units

OBSERVATION	POSSIBLE REMEDY
Fans won't start	All fans: Check power & wiring Check outdoor fan relay (OFR) OFM1, OFM3 only: Check speed control sensor location Check speed sensor resistance OFM2, OFM4 only: Check low ambient switch (LAS) Check low ambient relay (LAR)
Cooling — Center outdoor fans (OFM2, OFM4) off below approximately 60°F (16°C) outdoor ambient	Normal operation
Cooling — Center outdoor fans (OFM2, OFM4) not on above approximately 60°F (16°C) outdoor ambient	Check low ambient switch (LAS) Check low ambient relay (LAR)
Cooling — Slow fan speed for outer fans (OFM1, OFM3) at start or during low outdoor ambient	Normal operation
Cooling — Slow fan speed for outer fans (OFM1, OFM3) above 85°F (29°C) outdoor ambient (should be full speed)	Check speed control sensor location Check speed control sensor resistance Check fan motor capacitor
Cooling — motor current into speed control is greater than motor nameplate FLA	Normal operation Up to 30% higher amps at partial speed at low ambient

Heat Pump Units Only

OBSERVATION	POSSIBLE REMEDY
Fans won't start	All fans: Check power & wiring Check outdoor fan relay (OFR) OFM1, OFM3 only: Check speed control sensor location Check speed sensor resistance OFM2, OFM4 only: Check low ambient switch (LAS) Check low ambient relay (LAR)
Cooling — Center outdoor fans (OFM2, OFM4) off below approximately 60°F (16°C) outdoor ambient	Normal operation
Cooling — Center outdoor fans (OFM2, OFM4) not on above approximately 60°F (16°C) outdoor ambient	Check low ambient switch (LAS) Check low ambient relay (LAR)
Cooling — Slow fan speed for outer fans (OFM1, OFM3) at start or during low outdoor ambient	Normal operation
Cooling — Slow fan speed for outer fans (OFM1, OFM3) above 85°F (29°C) outdoor ambient (should be full speed)	Check speed control sensor location Check speed control sensor resistance Check fan motor capacitor
Cooling — motor current into speed control is greater than motor nameplate FLA	Normal operation Up to 30% higher amps at partial speed at low ambient
Cooling — condenser fans operate at full speed when below 60°F (16°C) outdoor ambient	Check that the SCB relay is not energized.
Heating — condenser fans operating at low speed when unit is heating	Verify that the SCB relay is energized